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REFERENCE DOCUMENT 1

METHOD FOR PRODUCING SOYBEAN LIPOPROTEIN GEL

ABSTRACT

The present invention is related to a method for producing a lipoprotein gel by processing the stock material comprising soybean or a mixture of soybean and defatted soybean meal by the steps of soaking, milling, leaching, heat treatment, acid precipitation, rinsing with water, buffer addition and neutralization with alkali. The lipoprotein gel produced possesses excellent adhesivity, water solubility and heat gelating ability; it serves as an additive in foods like ice-cream, soybean milk, red sausages, hams, imitated meat, breads, cakes, etc.

CLAIMS

1. A method for producing a lipoprotein gel, characterized in that a soybean lipoprotein gel is produced by processing the stock material comprising soybean or a mixture of soybean and defatted soybean meal by the steps of soaking, milling, leaching, heat treatment, acid precipitation, rinsing with water, buffer addition and neutralization with alkali.

2. A method according to claim 1, characterized in that soybean and

defatted soybean meal are mixed in a ratio of 1 : 0–100.

3. A method according to claim 1, characterized in that, during heat treatment step, the heat treatment temperature is maintained within a range of from 65°C to 130°C, and the heat treatment time is within a range of from 3 seconds to 30 minutes.

4. A method according to claim 1, characterized in that, during acid precipitation step, the pH of the solution is maintained within a range of from 1 to 6.

5. A method according to claim 1, characterized in that, during neutralization step, 0.01% to 0.5% of a phosphate or citrate of an alkali metal is added.

6. A method according to claim 1, characterized in that the acidic lipoprotein agglomerate is neutralized with alkali, wherein the pH of the lipoprotein gel is maintained within a range of 6.2 to 7.8.

7. A method according to claim 1, characterized in that the water content of the lipoprotein gel is maintained within a range of from 60% to 90%.

DESCRIPTION

Method for producing soybean lipoprotein gel

The present invention is directed to a method for producing foods, in particular to a method for producing foods comprising extracting fats and proteins from the stock material comprising soybean or a mixture of soybean and defatted soybean meal, thereby processing into a multifunctional edible lipoprotein gel.

Traditional processed soybean foods include tofu, dried tofu, etc. These old-fashioned soybean products are shaped agglomerate, no longer exhibit water solubility, adhesivity and heat gelating ability, and thus hardly bind to substances of different texture (e.g. meat paste). Thus, traditional soybean products are seldom used as starting materials in modern food industry. To solve this problem, Japanese patent no. 64-5870 discloses a method for producing Vienna sausages by subjecting tofu first to freezing followed by mixing with yolk, starch and meat paste, wherein freezed tofu has porosity and is readily to bind to substances of different texture. However, freezed tofu *per se* does not exhibit adhesivity. US patent no. US4284656 suggests producing protein curd using defatted soybean meal as the starting material; US patent no. US4579749 suggests producing chopped meat analogs using soybean as the starting material. However, both products do not exhibit water solubility and heat gelating ability. In recent years, Japanese patents, e.g. no. 59-4979, advocate the practice of using isolated soybean protein meal as the starting material and processing via high speed agitation and cryogenic storage. The food material thus produced, though having the above-mentioned features, is substantially produced from semi-finished material, in which more process steps and higher production cost are involved.

An object in the present invention is to provide a novel method, in which the stock material comprising soybean or a mixture of soybean and defatted soybean meal undergoes a series of processes to produce a lipoprotein gel product excellent in adhesivity, water solubility and heat gelating ability.

Detailed description of the invention

Soybean is soaked for 10 to 24 hours, followed by paste milling; alternatively, soaked soybean is mixed with defatted soybean meal, followed by paste milling. Defatted soybean meal is preferably a low-denatured meal, and stock soybean and defatted soybean meal are mixed in a ratio of 1 : 0–100, preferably of 1: 0.1–10. Soybean paste from paste milling undergoes extraction by adding water of 5 to 15 times as much as the amount of the stock material. To increase protein extraction rate, a diluted alkaline solution is added *quantum satis* to control the pH of the soybean milk within a range of from 6.5 to 11. The extract is then filtered to remove any residues, thus resulting in a soybean milk liquor. Such soybean milk liquor is subjected to heat treatment for passivation of lipase, so that the nutrient-inhibiting factor in the soybean is deactivated; this also serves to improve the flavour and properties of the product as well as to increase the viscosity of the product. Heat treatment of soybean milk liquor may be carried out in plate heat exchangers, tube heat exchangers, or high-temperature flash sterization; heat treatment temperature is maintained within a range of 65°C to 130°C, and heat treatment time is from 3 seconds to 30 minutes. Heat treated soybean

milk liquor is transferred to an acid precipitation tank equipped with agitators, and is added a food-grade acid solution (e.g. HCl solution, H_3PO_4 solution) for adjusting the pH of the soybean milk liqour within a range of 4 to 6. At the moment, the lipoprotein in the soybean milk liquor agglomerates instantaneously. Centrifuge or filter press is applied to separate the precipitated protein agglomerate from the milk supernatant. The protein agglomerate is washed with hot water and is further dewatered to a water content of from 50% to 85%. The resultant agglomerate still does not possess water solubility and heat gelating ability, and needs further treatment.

Further treatment includes neutralizing the lipoprotein agglomerate with an alkaline solution. Protein agglomerate prior to neutralization should be added 0.01% to 0.5% of a phosphate or citrate of an alkali metal, e.g. Na_2HPO_4, K_2HPO_4, sodium citrate, as the buffer which facilitates neutralization and prevents localized over-alkalinity.

Alkaline solution for neutralization may be selected from the group consisting of NaOH, KOH, Na_2CO_3, K_2CO_3, $KHCO_3$, etc. Neutralization is carried out in a neutralization tank, in which the lipoprotein is agitated and sprayed evenly with the alkaline solution, such that the pH of the neutralized lipoprotein gel is maintained within a range of from 6.2 to 7.8, and the water content is maintained within a range of from 60% to 90%.

Upon neutralization, lipoprotein transforms from a agglomerate state into a gel state, and undergoes great changes in property. In particular, neutralized lipoprotein possesses excellent water solubility, adhesivity

and heat gelating ability; said lipoprotein gel may be kept and transported under low temperature, or it may be stored after freeze-drying. Freeze-dried lipoprotein after rehydration still have same function as those before drying.

Example 1

10kg soybean is soaked for 20 hours, and is then milled with an abrasive wheel. 90 litres of water is added during milling. Milled soybean milk is filtered to remove any soybean residues, thus producing 85 litres of soybean milk. The soybean milk is heated up to 95°C for 10 minutes, then added a HCl solution until a pH of 5.5, and allowed to stand. The supernatant is decanted, and the settled protein is dewatered by a filter press and thus results in 12kg acidic protein agglomerate. The lipoprotein agglomerate is placed in a neutralization tank, added 100g of 30% Na_2HPO_4 solution, and agitated thoroughly. During agitation, a NaOH solution is sprayed until a pH of 6.7, thus producing 15kg creamy lipoprotein gel with a water content of 70%.

Example 2

5kg soybean is soaked for 10 hours. The soaking water is discarded, followed by adding 5kg defatted soybean meal (NSI 70%). The mixture is milled with water, and then filtered to remove soybean residues, thus producing 90 litres of soybean milk. The soybean milk is heated up to 100°C by direct steam for 3 minutes, then cooled to 70°C and added a diluted HCl solution until a pH of 5. The soybean milk supernatant is

removed by centrifuge, thus leaving 13kg of acidic lipoprotein agglomerate. The lipoprotein agglomerate is placed in a neutralization tank, added 100g of 30% Na_2HPO_4 solution, and agitated thoroughly. During agitation, a NaOH solution is sprayed until a pH of 7, thus producing 18kg lipoprotein gel with a water content of 75%; said lipoprotein gel possesses excellent water solubility, adhesivity and heat gelating ability.